CALIFORNIA INSTITUTE OF TECHNOLOGY

DIVISION OF GEOLOGICAL AND PLANETARY SCIENCES 170-25

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NASA Scientific and Technical
Information Facility
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TO WHOM IT MAY CONCERN

Enclosed are two copies of the Final Report for grant NAGW 1204 entitled, "A Dynamo Excitation Mechanism for the Electroglow on Uranus".

Sincerely,

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FINAL REPORT
FOR NAGW 1204

A Dynamo Excitation Mechanism for the Electroglow on Uranus

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Technical Officer: Henry Brinton

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FINAL REPORT

The fundamental problem in the thermospheres of the giant planets is the enormous UV airglow and high heating rates to substain the observed high temperatures. We will report our preliminary results here.

We propose that the diffuse FUV emissions of H and H_2 in excess of photoelectron excitation observed from the sunlit atmospheres of Uranus, Saturn, and Jupiter are produced by electric field acceleration of photoelectrons and ions locally in the upper atmospheres. This in situ acceleration is required to satisfy the many observational constraints on the altitude distribution, exciting particle energy, and total input energy requirements of the electroglow mechanism. The calculated altitude of charge separation by the neutral wind drag on ions across magnetic field lines is consistent with the observed peaks in electroglow emissions from the Voyager ultraviolet spectrometer limb scan data on both Saturn (near the homopause) and Uranus (just above the homopause). This dynamo action therefore appears to initiate the acceleration process, which must have the form of field-aligned potentials are due to anomalous resistivity, which results from sufficiently high field-aligned currents in the ionosphere to generate plasma instabilities and therefore runaway electrons and ions above some critical lower initial energy.

Work will be continued alone this line in order to establish the existence of suprathermal electrons ($E > 100$ eV) and their energy distributions.